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(54) Fluid hoses

(57) This invention relates to composite flexible hoses for hydraulic fluids, particularly for use in automobile clutch systems. The hose comprises an inner tube of nylon 6 or nylon 66 covered by a sheath of nylon 11 or nylon 12. The inner tube provides the major structural component of the hose and the sheath provides a shield against chemical attack from the environment in which the hose is located.

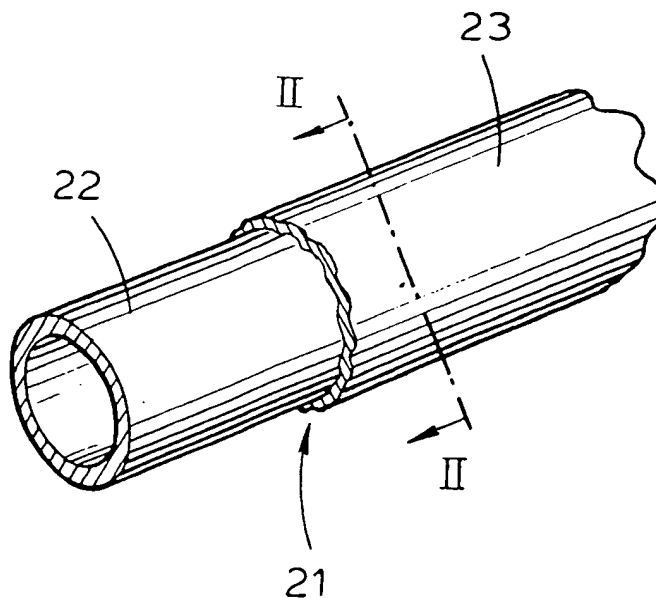


Fig. 1

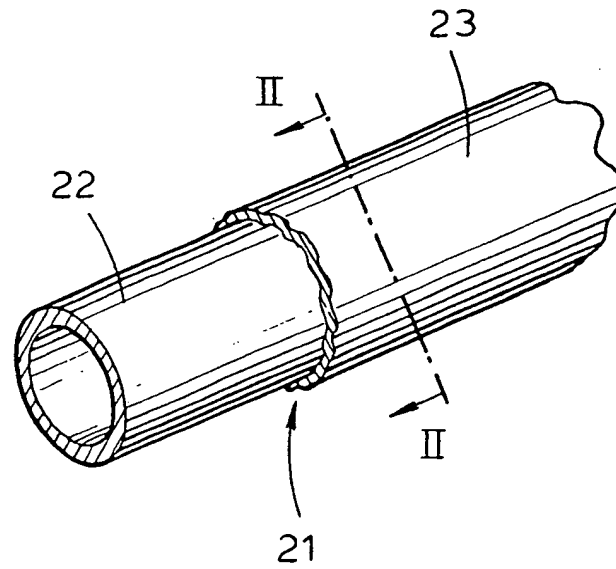


Fig. 1

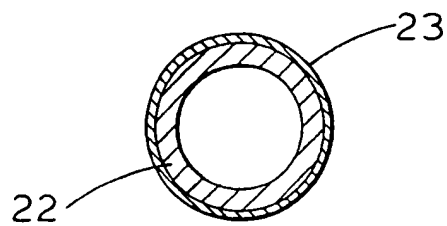


Fig. 2

## SPECIFICATION

## Fluid hoses

- 5 This invention relates to fluid hoses particularly hoses on automobiles, and which are located in a hostile environment in which aid hoses may be subject to chemical attack by mineral salt solutions, and the fluid, and
- 10 which are expected to withstand high pressures over a wide range of temperatures eg.  $-40^{\circ}\text{C}$  up to  $+130^{\circ}\text{C}$ . Such hoses are particularly but not exclusively used for hydraulic clutch systems of automobiles, and may be suitable for use as petrol hoses.

- 15 The prior art proprietary motor vehicle clutch hoses are formed from extruded tubes of nylon 11 or alternatively nylon 12 polyamide resins. Nylon 11 and nylon 12 have been used because they combine a number of desirable properties in that:-
- 20 a) they have the required chemical resistance to hydraulic fluids and petrol;
- b) they have low temperature flexibility and
- 25 c) they have resistance to a large number of inorganic chemical salts and their solutions, the more important ones being Sodium, Magnesium, Calcium Chlorides and Caustic Soda, all of these salts may be present, albeit some only in trace quantities in road salt.

- 30 However, a major defect of the proprietary nylon 11 and nylon 12 hoses, is that taking nylon 12 hose, for example, because of its low temperature flexibility at motor vehicle
- 35 under-bonnet temperatures of around  $100^{\circ}\text{C}$ , the tube wall becomes so flexible that when a hydraulic load is applied by the clutch master cylinder the internal pressure in the nylon 12 tube causes it to balloon outwards. This ballooning, coupled with the thermal expansion of the hose causes the total displacement of fluid from the master cylinder to be absorbed within the nylon 12 tube and not transferred through to the clutch hydraulic slave cylinder.
- 40 Hence, it can become difficult if not impossible to operate the vehicle clutch release mechanism at high under-bonnet temperatures, this is in excess of  $70^{\circ}\text{C}$ .

- One method of reducing this problem to acceptable limits is to thicken up the wall thickness of the nylon 12 hose so that it has sufficient rigidity to say  $100^{\circ}\text{C}$  to reduce the ballooning effect to a minimum. A typical increase in thickness would be a prior art
- 55 proprietary pipe having a 5 mm bore and an external diameter of 8 mm, having its wall thickness increased to 2 mm. However, nylon 11 and nylon 12 are very expensive materials and such an increase in wall thickness is not commercially desirable.

- 60 Accordingly there is provided a composite flexible hose for fluids and comprising as the major structural component, an inner tube of a polyamide material having the characteristics of hardness, and flexural strength not

lower than such characteristics of nylon 6, and a sheath of a polyamide material having a resistance to chemical attack by mineral salts not inferior to that of nylon 11.

- 70 Also according to this invention there is provided a method of manufacture of a hose, as disclosed herein, wherein the other polyamide sheath is extruded onto a formed tube of said one polyamide resin.

- 75 The invention will be described by way of example and with reference to the following drawing in which:-

- Figure 1 is an isometric view of a hose according to this invention showing the outer sheath removed from a portion of its length; and

Figure 2 is a section on the line II-II of Fig. 1.

- A hose 21 comprises an extruded tube 22 formed from nylon 6 or nylon 66 polyamide resin, having a sheath 23 of nylon 11 or nylon 12 polyamide resin extruded on the outer surface thereof.

- For the avoidance of doubt the polyamide resins referred to are defined as follows:-

Nylon 6 is Polycaprolactam,

Nylon 66 is the condensation product of Hexamethylene Diamine and Adipic Acid,

- Nylon 11 is derived from Amino Undecanoic Acid and

Nylon 12 is derived from Laurin Lactam.

- Nylon 6 or 66 tube 22 would be expected to have a minimum bore of approximately 3 mm but preferably 5 mm and a maximum external diameter of about 10 mm but preferably 8 mm. The nylon 6 or 66 tubing would provide the necessary strength and rigidity at under-bonnet temperatures e.g.  $100^{\circ}\text{C}$ – $130^{\circ}\text{C}$  for about half the cost of a solid nylon 11 or nylon 12 tube of the same dimensions. The required chemical resistance is then provided by a protective sheath 23 of nylon 11 or nylon 12.

- Such a composite tube would be expected to withstand a minimum burst of pressure of 200 Bars at  $23^{\circ}\text{C}$ .

## CLAIMS

1. A composite flexible hose for fluids and comprising as the major structural component, an inner tube of a polyamide material having the characteristics of hardness, and flexural strength not lower than such characteristics of nylon 6, and a sheath of a polyamide material having a resistance to chemical attack by mineral salts not inferior to that of nylon 11.

2. A hose as claimed in Claim 1, wherein the sheath is formed from the polyamide resin nylon 12.

3. A hose as claimed in Claim 1, wherein the sheath is formed from the polyamide resin nylon 11.

4. A hose as claimed in one of Claims 1 to 3, wherein the inner tube is formed from the polyamide nylon 6.

5. A hose as claimed in one of Claims 1 to 3, wherein the inner hose is formed from the polyamide nylon 66.
6. A hose as claimed in anyone of Claims 1 to 5, wherein the hose can withstand a minimum burst of pressure of 200 Bars.
7. A hose substantially as described herein, and as shown in the accompanying drawings.
- 10 8. A vehicle hydraulic clutch system including a hose as described in any preceding claim.
9. A method of manufacture of a composite hose as claimed in any preceding claim,
- 15 wherein the outer polyamide resin sheath is extruded onto an already formed inner tube.

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